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First record of the alien freshwater jellyfish *Craspedacusta sowerbii* Lankester, 1880 (Cnidaria: Hydrozoa: Olindiidae) in Syria

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ABSTRACT

In this work, we present the first record of the freshwater jellyfish species *Craspedacusta sowerbii* Lankester, 1880 in Syria. The medusa stage of *C. sowerbii* was observed in Al-Haffa dam reservoir, about 25 km to the northeast of Lattakia city, on August the 28th 2021, during a zooplankton study conducted in the Syrian freshwater bodies. The origin of the alien species *C. sowerbii* is China, which has dispersed worldwide since the 19th century. Our knowledge of its presence in the Middle East is very limited to a few records; therefore, it is hoped that the current work will present a contribution to the previous records of this alien species in the Mediterranean region and the Middle East. In addition, this new finding could be interpreted as being a part of the outcome of the cumulative effect of a global climate change.

Keywords: freshwater jellyfish, *Craspedacusta sowerbii*, alien species, Syria.

1. INTRODUCTION

Global warming and several anthropogenic stressors such as pollution, climatic change, urbanization, eutrophication, artificial waterways and commercial navigation on rivers, represent the most serious threats to the aquatic ecosystem integrity and biodiversity. Such stressors facilitates non-indigenous species (NIS) to move on and establish thriving populations and massive blooms in new locations. The establishment of alien species has serious environmental and socio-economic impacts (Galil et al., 2014; Boudouresque et al., 2017; Mannino et al., 2017).

Craspedacusta sowerbii Lankester, 1880, is a freshwater jellyfish species belonging to the phylum Cnidaria, class Hydrozoa, order Limnomedusae, family Olindiidae, and the genus *Craspedacusta* (Kramp, 1961; Cairns et al., 2002; Kriska, 2013).

The *C. sowerbii* life cycle consists of two stages: polyp and medusa. It is able to reproduce both asexually and sexually (Folino-Rem et al.,

2016). Polyp form has a wider distribution than the medusa form. However, because it is tiny and unremarkable compared to the larger medusa, the appearance of the *C. sowerbii* Medusa stage is typically considered as an evidence of this species' existence within an aquatic habitat (Duggan and Eastwood, 2012). *C. sowerbii* medusae are only produced irregularly and sporadically, therefore, several years may pass between the occurrences of blooms in a given location (DeVries, 1992; Peard, 2002; Ma and Purcell, 2005). *C. sowerbii* Medusa blooms require a water temperature of above 25°C; therefore, they typically occur during late summer and early fall (Folino-Rorem et al., 2016). Other factors that may influence medusa blooms include food availability, and increased nutrient inputs (Angradi, 1998; Boothroyd et al. 2002). Polyps reproduce by budding motile frustules, they can move and attach to stable substrate and develop into new polyps. In addition, polyps have the ability to develop durable podocysts, with a chitin-like protective membrane that allows them to resist long periods of food shortage and to tolerate extreme conditions. Once adverse conditions are lifted, the podocysts grow again into polyps under convenient conditions. Both frustules and podocysts serve as appropriate life forms for anthropogenic transmission (Fritz et al., 2007; Gomes-Pereira and Dionísio, 2013; Folino-Rorem, 2015).

C. sowerbii is carnivorous, the diet of both medusae and polyps include a variety of copepods, cladocerans, and rotifers. Thus, during blooms, they may significantly cause declines in zooplankton communities, and subsequently, they have a negative effect on the aquatic food webs through reducing the food availability of fish and other zooplanktivorous organisms. (Jankowski et al., 2005; Smith and Alexander, 2008; Moreno-Leon and Ortega-Rubio, 2009; Stefani et al., 2010; Lucas et al., 2013). *C. sowerbii* nematocysts stings can paralyze zooplankton, small fish and some aquatic invertebrates, but they are not dangerous to humans (Peard, 2002).

C. sowerbii is the most successful invasive freshwater jellyfish species occurring in both natural and artificial freshwater bodies. This species is native to China (Kramp, 1950; Jankowski, 2001), and since the 19th century, it has colonized subtropical to temperate regions and is widely distributed in all continents, except Antarctica (Duggan and Eastwood, 2012; Marchessaux and Bejean, 2020).

An increasing number of reports on new distribution of *C. sowerbii* have been recently published, that contribute to increasing our knowledge about the spatial spread of this species. Here, we describe the presence of the alien freshwater jellyfish in Syria for the first time.

2. MATERIEL AND METHODS

Al-Haffa dam was constructed in 1975 and is located at about 25 km to the northeast of Lattakia city (35°36'30.25"N; 36°1'54.59"E). The dam holds about 2.5 million-square meters of water and generally considered as being somewhat pure as it is situated far from any source of pollution. It is, therefore, an important source of drinking water, and to a lesser extent for irrigation purposes. (Fig. 1). The bottom of the reservoir consists of gravel. The water temperature ranges between 11 and 30°C annually.

Only three medusae specimens of this new freshwater jellyfish species were found swimming, just below the water surface of the Al-Haffa dam reservoir, on the 28 August 2021, during a zooplankton sampling campaign conducted there.

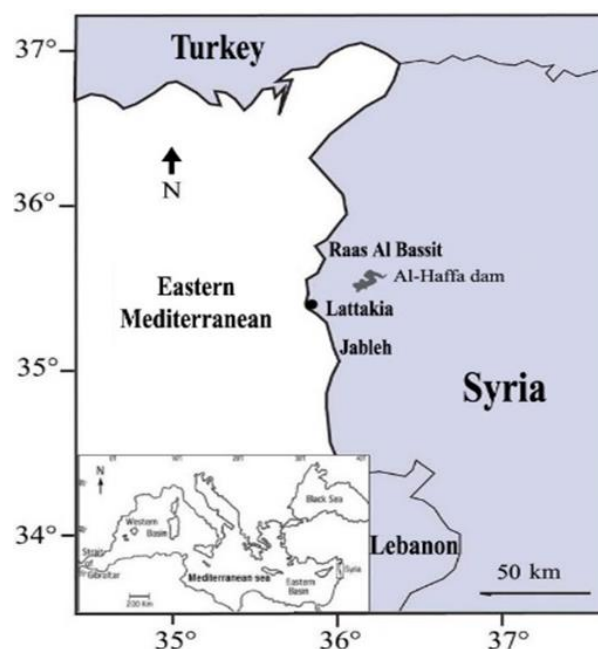


Figure 1. Map of the western part of Syria showing Al-Haffa dam where *C. sowerbii* was found

All the specimens were caught carefully using a hand-net at a distance of about 1m from the reservoir edge, and at a depth of about 0.5 m from the surface. The water was somewhat not turbid, and the atmosphere temperature at the time of sampling was 27.8 °C. The specimens were taken immediately to the laboratory, where they were examined, photographed, fixed in 4% formalin and deposited in the collection of the Zoology Department at Tishreen University. (Fig. 2).

The reservoir was surveyed several times during the zooplankton study, no polyps or medusae were previously found.

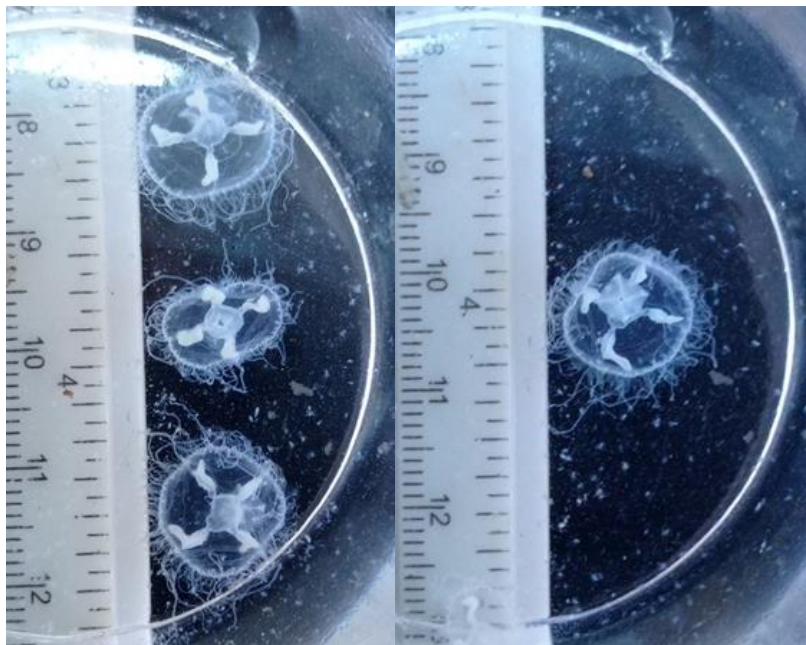


Figure 2. *Craspedacusta sowerbii* found in Al-Haffa dam reservoir, Syria.

3. RESULTS AND DISCUSSION

Upon examination of the new freshwater jellyfish species it was identified as *Craspedacusta sowerbii* Lankester, 1880 (phylum Cnidaria, class Hydrozoa, order Limnomedusae, family Olindiidae, and the genus *Craspedacusta*) by its unique and remarkable morphology based on relevant characters described by other researchers (Kramp, 1961; Cairns et al., 2002; Bouillon et al., 2004; Bouillon and Boero, 2000; Kriska, 2013). The diameter of the transparent bell-shaped umbrella of the collected specimens was between 11 and 13 mm, with 4 radials opaque-white gonads. The tentacles are protruding from the umbrella edge and they vary in lengths, where the shorter tentacles numbered much more than the longer ones. In addition, the medusa exhibits 4 very long tentacles parallels to radial canals. The total number of tentacles is ranging between 350 and 400 (Fig. 2).

The presence of *C. sowerbii* medusae in Al-Haffa dam reservoir in August was consistent with what has been recorded in other neighboring areas, which confirms that this freshwater jellyfish species is usually found during summer in temperate regions. The high water temperatures contributes to the increase in zooplankton abundance, which in turn affects the increase of medusa size and its reproductive activity (Dumont, 1994; Lundberg and Svensson, 2003; Arbaciauskas and Lesutiene, 2005; Gasith et al., 2011).

Our finding of *C. sowerbii* medusae swimming just below the water surface is a common feature of this species, which usually appears on the surface of shallow waters (Perez-Bote et al., 2006). Al-Haffa dam reservoir was surveyed several times during the zooplankton study, no polyps or medusae had been previously found neither in this reservoir nor in the other Syrian natural and artificial water bodies. The present record of the medusa stage suggested that *C. sowerbii* species has an established population in AL-Haffa dam reservoir. It is difficult to know exactly how this alien species arrived there. The most likely assumption about the way it was introduced points towards the *C. sowerbii* podocysts or frustules possibly being transported accidentally by animals and aquatic plants and on the mud off the feet of migratory birds (Smith, 2012; Morpurgo and Alber, 2015). In general, artificial water bodies like reservoirs, ponds, and dam lakes provide a good condition for development of the *C. sowerbii* fragile medusae and for easy field observations (Gomes-Pereira and Dionísio, 2013; Özbek and Sömek, 2020).

The *C. Sowerbii* Medusa was discovered for the first time in 1880, in London (Payne, 1924). Later on, it has been recorded in several European countries: France, Italy, Sweden, Spain, Portugal and Greece (Ferreira, 1985; Gomes-Pereira and Dionísio, 2013; Karaouzas et al., 2015). Also, in North and South America, Canada, Hawaii, Australia, New Zealand, and Japan (Ferreira, 1985; Akcaalan et al., 2011;

Marchessaux and Bejean, 2020), as well as, several records in the Middle Eastern countries. The first record in the Middle East was in 1956 from a lake located in the Nile Delta, Egypt (Dumont, 1994). The next one was recorded near Baghdad (Saadalla, 2006). Later, it was found in a small pond near the Sea of Galilee (Gasith et al., 2011). Then it was recorded near Tehran (Bagheri et al., 2017). Recently, there were eight records of this freshwater jellyfish in Turkey (Özbek and Sömek, 2020). *C. sowerbii* is mainly observed in a range of shallow, slow moving or stagnant natural and artificial freshwater bodies such as rivers, lakes, reservoirs, gravel pits and artificial ponds (Dumont, 1994; Silva and Roche, 2007; Fritz et al., 2009; Smith, 2012; Killi et al., 2021).

4. CONCLUSION

In this work, we presented the first record of the freshwater jellyfish species *Craspedacusta sowerbii* Lankester, 1880 in Syria. The medusa stage of this alien species was observed in Al-Haffa dam reservoir, about 25 km to the northeast of Lattakia city, on the year 2021 during August, a time during which there is a marked increase in temperature. The recording of medusa stage suggested that *C. sowerbii* species has managed to establish its population in AL-Haffa dam reservoir. The most likely assumption for the way the jellyfish was introduced points to the *C. sowerbii* podocysts or frustules possibly being transported accidentally by animals, aquatic plants and/or mud on the feet of migratory birds.

C. sowerbii is considered as one of the most important bioindicator species for climate change. It is a native species to China, and this new finding could be interpreted as a result of a cumulative effect of a global climate changes that affect the biodiversity of west Asia and Mediterranean region, which leads rapidly to the threat of alien species spreading into the affected region.

C. sowerbii presence has usually an important influence on freshwater ecosystem, with a negative effect on zooplankton communities. Therefore, a detailed study for the population dynamics of both the polyp and the medusa forms of this alien species should be conducted in Al-Haffa dam reservoir. In addition, a program for surveying and monitoring the presence of this alien species in Syrian freshwater bodies should be initiated.

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Authors' contributions:

All authors are equal in contributing to this work.

Ethical approval

Freshwater jellyfish species *Craspedacusta sowerbii* Lankester, 1880 were recorded from Al-Haffa dam reservoir, in Syria. The Animal ethical guidelines are followed in the study for species observation & identification.

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Conflicts of interests

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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